

IN THE CLAIMS:

- 1 1. (Amended) An electronic system, comprising a single device having a light emitting
2 portion, and a magnetically sensitive portion, and an energy barrier, wherein said
3 energy barrier is between said magnetically sensitive portion and said light emitting
4 portion, wherein said magnetically sensitive portion is capable of modulating a hot
5 electron current flowing across said energy barrier to said light emitting portion is for
6 modulating light emission from the said light emitting portion.
- 1 2. (Amended) An electronic system, as recited in claim 1, wherein said single device is
2 for converting a magnetic digital signal directly into an optical digital signal.
- 1 3. (Amended) An electronic system, as recited in claim 2, wherein said ~~system~~ single
2 device is for converting said magnetic digital signal to both an electrical digital
3 signal and into said optical digital signal, wherein either or both of said signals can
4 be provided as a device output.
- 1 4. (Original) An electronic system, as recited in claim 1, wherein said magnetically
2 sensitive portion comprises a magnetically permeable material.
- 1 5. (Amended) An electronic system, as recited in claim 1, wherein said single device
2 comprises includes a three-terminal light-emitting transistor, said transistor
3 comprising having an emitter, a base, and a collector, wherein said light is emitted
4 from said collector.

- 1 6. (Amended) An electronic system, as recited in claim 5 2, ~~wherein said base~~
2 ~~comprises said magnetically sensitive portion for receiving a digital magnetic control~~
3 ~~signal~~; wherein said magnetically sensitive portion ~~comprises~~ includes a magnetic
4 switch, wherein switch position is determined by said ~~digital~~ magnetic digital control
5 signal, wherein a first intensity of light is emitted in a first switch position and a
6 second intensity of light is emitted in a second switch position, wherein said first
7 intensity is greater than said second intensity.
- 1 7. (Amended) An electronic system, as recited in claim 5, wherein said transistor
2 comprises ballistic spin filtering to spin polarize and analyze electrons ~~for operation~~
3 ~~of said switch~~.
- 1 8. (Original) An electronic system, as recited in claim 7, wherein said transistor
2 comprises a pair of magnetically permeable layers, wherein when said magnetically
3 permeable layers are aligned said spin polarized electrons penetrate and when anti-
4 aligned, said spin polarized electrons are attenuated.
- 1 9. (Withdrawn) An electronic system, as recited in claim 8, wherein said magnetically
2 permeable layers are both located in said base.
- 1 10. (Original) An electronic system, as recited in claim 8, wherein one of said pair of
2 magnetically permeable layers is located in said base and one of said pair of
3 magnetically permeable layers is located in said emitter.
- 1 11. (Original) An electronic system, as recited in claim 5, wherein said emitter is tunnel
2 coupled to said base across an insulator.

- 1 12. (Amended) An electronic system, as recited in claim 5, wherein said single device
2 ~~comprises~~ includes a buried quantum well within a semiconductor collector, wherein
3 said quantum well is formed of a quantum well material having a lower band gap
4 than adjacent material.
- 1 13. (Original) An electronic system, as recited in claim 12, wherein said material having
2 a lower band gap has a direct transition for more efficient generation of light in said
3 quantum well.
- 1 14. (Original) An electronic system, as recited in claim 12, wherein said semiconductor
2 collector further comprises a Schottky contact region.
- 1 15. (Original) An electronic system, as recited in claim 14, wherein said semiconductor
2 collector further comprises an n type Schottky contact region, an undoped quantum
3 well region, and a p type substrate layer heterostructure.
- 1 16. (Amended) An electronic system, as recited in claim 12, wherein said light emitted
2 by said single device comprises photons having an energy approximately equal to the
3 said band gap of said quantum well material.
- 1 17. (Amended) An electronic system, as recited in claim 5, wherein said emitter is
2 capable of providing ballistic electrons across said base to said collector when an
3 emitter-base bias is provided with a potential exceeding a ~~collector-base~~ said energy
4 barrier.
- 1 18. (Amended) An electronic system, as recited in claim 17, wherein said ~~collector-base~~
2 energy barrier comprises a base-collector Schottky barrier.

1 19. (Amended) An electronic system, as recited in claim 5, wherein said single device
2 comprises a spin valve transistor having a ~~base-collector barrier~~, a source for
3 complementary carriers[[,]] and a place for recombining to generate said photons,
4 wherein said energy barrier comprises a base-collector energy barrier.

1 20. (Amended) An electronic system, as recited in claim 19, wherein said ~~base-collector~~
2 base-collector energy barrier comprises a Schottky barrier, said source for
3 complementary carriers comprises a p-type substrate layer, and said place for
4 recombining comprises a quantum well.

1 21. (Withdrawn) An electronic system, as recited in claim 19, wherein said spin valve
2 transistor includes a base having a first magnetically permeable layer and a second
3 magnetically permeable layer.

1 22. (Withdrawn) An electronic system, as recited in claim 21, wherein said first
2 magnetically permeable layer is ferromagnetic.

1 23. (Withdrawn) An electronic system, as recited in claim 21, wherein said second
2 ferromagnetic magnetically permeable layer has a lower coercive field level than said
3 first ferromagnetic magnetically permeable layer so said second layer can be
4 switched without switching said first layer to provide for turning on and turning off
5 current in said single device with an intermediate level magnetic field.

1 24. (Withdrawn) An electronic system, as recited in claim 23, wherein said spin valve
2 transistor includes a base-collector contact comprising a Schottky barrier diode
3 having a Schottky barrier height.

- 1 25. (Withdrawn) An electronic system, as recited in claim 24, wherein said Schottky
2 barrier diode provides that only ballistic electrons having energy at least equal to said
3 Schottky barrier height are injected into said collector.
- 1 26. (Withdrawn) An electronic system, as recited in claim 25, wherein said transistor
2 comprises a variable emitter-base voltage and an independently variable collector-
3 base voltage.
- 1 27. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor
2 emits photons only when said emitter-base voltage exceeds a threshold
3 approximately equal to the said Schottky barrier height.
- 1 28. (Withdrawn) An electronic system, as recited in claim 26, wherein said transistor
2 emits photons only when said collector-base voltage exceeds a threshold
3 approximately equal to the difference between said bandgap of said collector and
4 said Schottky barrier height.
- 1 29. (Withdrawn) An electronic system, as recited in claim 28, further comprising a first
2 power supply for providing an electrical potential across a collector-base junction of
3 said transistor, wherein when said electrons are injected into said collector over a
4 Schottky barrier with an energy at least equal to energy of said Schottky barrier, the
5 combination of this electron energy and said potential energy provided by said first
6 power supply provides said electrons with enough potential energy to generate
7 photons from recombination in said quantum well.

- 1 30. (Withdrawn) An electronic system, as recited in claim 29, further comprising a
2 second power supply for providing an electrical potential across an emitter-base
3 junction of said transistor, wherein said emitter provides ballistic electrons at an
4 energy exceeding said Schottky barrier when sufficient emitter-base potential is
5 provided.
- 1 31. (Original) An electronic system, as recited in claim 5, wherein said collector
2 comprises an n type region and a p type region and a region-there-between, wherein
3 said region-there-between has a lower band gap than either said n type region or said
4 p type region so as to trap both electrons and holes for facilitating recombination and
5 photon generation.
- 1 32. (Original) An electronic system, as recited in claim 31, wherein said region-there-
2 between is undoped or lightly doped.
- 1 33. (Withdrawn) An electronic system, as recited in claim 5, wherein emitter-base
2 contact comprises a second Schottky diode energy barrier.
- 1 34. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device
2 comprises a two-terminal light-emitting transistor, said two terminal transistor
3 comprising a base and a collector, wherein said light is emitted from said collector,
4 wherein said base of said two terminal transistor is exposed for receiving sub-band
5 gap photons to provide internal photo-emission of charges in said base.
- 1 35. (Withdrawn) An electronic system, as recited in claim 1, further comprising wherein
2 said single device is included in a magnetic read head, wherein said single device
3 that converts magnetic information into an optical signal.

1 36. (Withdrawn) An electronic system, as recited in claim 1, further comprising an array
2 of said single devices for storing information and for converting said stored
3 information into optical signals.

1 37. (Withdrawn) An electronic system, as recited in claim 1, wherein said single device
2 further comprises amplification.

1 38. (Withdrawn) An electronic system, as recited in claim 1, further comprising a power
2 supply, wherein said single device comprises a collector and a base, wherein said
3 power supply is connected for providing a collector-base voltage sufficient to
provide secondary electrons by impact ionization to provide amplification.

- 1 39. (Amended) An electronic system, comprising a metal base hot ~~electron metal base~~
2 carrier transistor having a metal base, a collector, and an energy barrier, said energy
3 barrier between said metal base and said collector to block thermalized carriers in
4 said metal base, said collector having a quantum well for facilitating light emission.
- 1 40. (Amended) An electronic system, as recited in claim 39, wherein said transistor
2 comprises a pair of ferromagnetic layers wherein one of said layers can have its
3 magnetization orientation switched independently of the other layer to facilitate
4 magnetic switching between a first magnetic switch position and a second magnetic
5 switch position.
- 1 41. (Amended) An electronic system, as recited in claim ~~39~~ 40, wherein a first intensity
2 of light is emitted in a said first magnetic switch position and a second intensity of
3 light is emitted in a said second magnetic switch position, wherein said first intensity
4 of light is greater than said second intensity of light.
- 1 42. (Withdrawn) An electronic system, as recited in claim 39, wherein said transistor
2 comprises ballistic spin filtering to spin polarize and analyze said ~~charges~~ carriers for
3 ~~operation of said switch.~~
- 1 43. (Original) An electronic system, as recited in claim 39, wherein said metal base
2 comprises a ferromagnetic layer.
- 1 44. (Withdrawn) An electronic system, as recited in claim ~~43~~ 39, wherein said metal
2 base comprises a pair of magnetically permeable layers, wherein when said
3 magnetically permeable layers are aligned ~~said~~ spin polarized ~~charges~~ carriers
4 penetrate and when anti-aligned, ~~said~~ spin polarized ~~charges~~ carriers are attenuated.

- 1 45. (Withdrawn) An electronic system, as recited in claim 39, ~~further comprising~~
2 wherein said transistor is included in a magnetic read head, wherein said transistor
3 that converts magnetic information into an optical signal.
- 1 46. (Withdrawn) An electronic system, as recited in claim 39, further comprising an
2 array of said ~~devices~~ transistors for storing information and for converting said stored
3 information into optical signals.
- 1 47. (Withdrawn) An electronic system, as recited in claim 39, wherein said ~~single device~~
2 transistor further comprises amplification.
- 1 48. (Amended) An electronic system, as recited in claim ~~39~~ 47, wherein said transistor
2 comprises ~~a collector, a base, and~~ a power supply for providing a collector-base
3 voltage sufficient to provide secondary electrons by impact ionization to provide said
4 amplification.
- 1 49.-54. Cancel

- 1 55. (New) An electronic system, comprising a metal base hot carrier transistor having a
2 metal base and a collector, an energy barrier between said metal base and said
3 collector to block thermalized carriers, said metal base hot carrier transistor further
4 comprising a spin filter.
- 1 56. (New) An electronic system, as recited in claim 55, wherein said spin filter
2 comprises ballistic spin filtering to spin polarize and analyze said carriers.
- 1 57. (New) An electronic system, as recited in claim 55, wherein said spin filter
2 comprises a ferromagnetic layer located in said metal base.
- 1 58. (New) An electronic system, as recited in claim 55, wherein said metal base
2 comprises a pair of magnetically permeable layers, wherein when said magnetically
3 permeable layers are aligned, carriers penetrate and when said magnetically
4 permeable layers are anti-aligned, said carriers are attenuated.
- 1 59. (New) An electronic system, as recited in claim 55, wherein said spin filter includes
2 a pair of ferromagnetic layers, wherein one of said ferromagnetic layers is capable of
3 having its magnetization orientation switched independently of the other
4 ferromagnetic layer to facilitate magnetic switching between a first magnetic switch
5 position and a second magnetic switch position
- 1 60. (New) An electronic system, as recited in claim 59, wherein a first intensity of light
2 is emitted in said first magnetic switch position and a second intensity of light is
3 emitted in said second magnetic switch position, wherein said first intensity of light
4 is greater than said second intensity of light.

- 1 61. (New) An electronic system, as recited in claim 55, wherein said transistor is
2 included in a magnetic read head, wherein said transistor converts magnetic
3 information into an optical signal.
- 1 62. (New) An electronic system, as recited in claim 55, further comprising an array of
2 said transistors for storing information and for converting said stored information
3 into optical signals.
- 1 63. (New) An electronic system, as recited in claim 55, further comprising an optical
2 structure, wherein said optical structure is arranged to collect light emitted by said
3 light emitting portion.
- 1 64. (New) An electronic system, as recited in claim 1, further comprising an optical
2 structure, wherein said optical structure is arranged to collect light emitted by said
3 light emitting portion.
- 1 65. (New) An electronic system, as recited in claim 39, further comprising an optical
2 structure, wherein said optical structure is arranged to collect light emitted by said
3 quantum well.
- 1 66. (New) An electronic system, as recited in claim 39, wherein said transistor further
2 comprises amplification.
- 1 67. (New) An electronic system, as recited in claim 39, wherein said transistor comprises
2 a power supply for providing a collector-base voltage sufficient to provide secondary
3 electrons by impact ionization to provide said amplification.